

Coleman in the July 4 *PHYSICAL REVIEW LETTERS*, "There [had] been, however, no explicit demonstration that the thermonuclear burn occurs within the compressed target core, nor had the spatial distribution of the fusion events within the burn region been measured."

The report concerns two experimental shots by the laboratory's Argus facility that the experimenters consider representative of a series. The earlier claims that fusions had taken place in imploded pellets were based on the recording of sizable numbers of neutrons with energies characteristic of neutrons given off in the particular fusion reactions under study (deuterium-tritium for the laser experiments and deuterium-deuterium for the electron-beam work). The thermonuclear-burn claim is based on measurements of another product of the D-T reaction, alpha particles.

The alpha particles were used to reconstruct an image of the thermonuclear-burn region in the centers of the imploded targets by a procedure called zone-plate-coded imaging. The technique combines elements of pin-hole photography and holography. The alpha particles from the targets are passed through a plate with circular zones (Fresnel zones) and produce a shadowgraph by making pinholes in a detecting sheet in the areas where the zone plate has let them through. A photographic image is made from the pin-holed shadowgraph and used like a holograph to reconstruct an image of the burn.

The two shots (designated A and B) irradiated targets with diameters of 86 and 88 microns. The laser power for shot A was 2.4 terawatts, for shot B 3.9 terawatts. After the pellets were crushed, the thermonuclear-burn regions turned out to have ovoid shapes. The major axis for shot A was 29 microns; the minor axis was 26 microns. The axes for shot B were 26 and 22 microns.

Conditions in those regions included ion temperatures of 5,600 electron-volts for shot A and 7,000 electron-volts for shot B. The ion densities were 6.3×10^{21} and 1.7×10^{22} ions per cubic centimeter respectively. (The numbers of deuterium and tritium ions in each case were equal.) Thermonuclear burn lasted 36 picoseconds for shot A and 27 picoseconds for shot B. "The size and shape of the D-T burn region of compressed, laser-driven fusion targets have been measured by the ZPCI alpha imaging technique and the concurrence of the results with the measured fusion yield ... has been demonstrated," Ceglio and Coleman conclude.

"These measurements provide an explicit demonstration that the thermonuclear burn produced by laser-driven implosions does indeed occur within a compressed core of the imploded target." Further work will attempt similar imaging of the superthermal X-rays and fast ions emitted in pellet-crushing shots to gain further data about conditions in the centers of the pellets. □

The biofeedback picture: Negative

Biofeedback, the darling of many behavioral researchers in the late 1960s and early '70s, is beginning to show some apparent flaws as it approaches adolescence. The technique—in which a person seeing a display of his own heartbeat, brainwave pattern, blood pressure or other "feedback" signal is able to control such bodily functions—was instantly hailed as immediate, electronic meditation. It would, researchers suggested, enable hyperactive persons to relax and hypertensives to lower blood pressure. More extravagant claims linked the process to weight loss, improved health and memory, gaining friends and quitting smoking. Scores of biofeedback machine manufacturers sprung up, touting their product in a manner similar to that of present-day citizens-band radio makers.

But the fad days of biofeedback have progressed into an era of more careful, comprehensive study and consequently, some less encouraging findings about the technique's effects. Last year, University of Pennsylvania researchers reported findings that cast considerable doubt on biofeedback's ability to produce the relaxing, introspective alpha rhythm state in human beings (SN: 3/6/76, p. 148).

Now, research psychologists at the University of Kansas report results that raise "serious questions concerning the effectiveness of ... 'biofeedback training' for altering heart rate." Citing "inconsistencies" in past work, Thomas W. White, David S. Holmes and David H. Bennett set out to find whether biofeedback enabled people to lower or raise their heart rate any better than if they used different methods, or none at all.

In the experiment, reported in the July *JOURNAL OF EXPERIMENTAL PSYCHOLOGY*, the researchers compared biofeedback's effectiveness against:

- Simply instructing subjects to change their heart rates. According to biofeedback proponents, being able to "see" your heart rate slow down or speed up is critical in control.
- Asking subjects to sit quietly, without instructions or feedback.
- Encouraging participants to conjure up cognitive thoughts of exciting or relaxing nature.

In studying 90 male and 90 female undergraduates, the researchers also examined whether biofeedback is more effective in slowing heart beat or speeding it up, and whether the sex of the subject makes any difference. In addition, biofeedback subjects were further compared to students who unknowingly received false feedback from a machine wired to a random voltage generator that caused the needle to register random changes unrelated to actual heart rate.

The results, the psychologists report,

"revealed no value whatsoever in heart rate biofeedback." Attempts, through biofeedback, to decrease heart rate, "were completely ineffective. When appropriate control groups were considered, all decreases in heart rate could be attributed to a simple adaptation [non-feedback] effect," say White, Holmes and Bennett. Results in decreasing heart rate did not differ significantly between biofeedback subjects and those who were simply instructed to slow down their heart without feedback or asked to sit quietly. "This conclusion is in sharp contrast to many previous experiments," say the Kansas team members. "Unfortunately," they add, "those experiments lacked the [necessary] control groups."

Overall, biofeedback training offered no significant advantages in raising or lowering heart rate when compared to any other of the controls. In most cases, differences among sexes were not significant. "The present experiment included a number of controls that were not employed in the previous experiments," the researchers say, "and these controls place the performance of subjects who received biofeedback in a completely different perspective." □

New hope for a gonorrhea vaccine

A research group has obtained preliminary success with an experimental vaccine against gonorrhea. Members of the University of Pittsburgh team, who tested the vaccine on themselves with favorable results, now plan on pursuing an expanded test program on 50 to 100 persons.

The incidence of gonorrhea has grown to epidemic magnitude, increasing by 1 percent per month during the past decade. This past year, there were an estimated 10 million cases of infection in the United States alone. The severity of the problem has been further aggravated by the relatively recent appearance of a gonococcal strain resistant to penicillin, the traditional treatment.

Charles C. Brinton and four colleagues formulated their vaccine from parts of the offending gonococcus bacterium. The vaccine is derived from the pili (Latin for hair)—slender tentacles that mobilize the gonococcus and adhere to afflicted tissue. Pili in general have been spoken of in relation to possible vaccines against various diseases for several years (SN: 5/10/75, p. 301).

After being inoculated, the researchers' bodies responded by manufacturing the appropriate combative antibodies. In another phase of the experiment, two of the researchers were immunized and then all five deliberately infected with gonococcus. The immunized pair manifested a greater resistance to detectable gonococcal infection than the others. □